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Voice pitch influences voting behavior☆

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Abstract

It may be adaptive for voters to recognize good leadership qualities among politicians. Men with lower-pitched voices are found to be more dominant and attractive than are men with higher-pitched voices. Candidate attractiveness and vocal quality relate to voting behavior, but no study has tested the influence of voice pitch on voting-related perceptions. We tested whether voice pitch influenced perceptions of politicians and how these perceptions related to voting behavior. In Study 1, we manipulated voice pitch of recordings of US presidents and asked participants to attribute personality traits to the voices and to choose the voice they preferred to vote for. We found that lower-pitched voices were associated with favorable personality traits more often than were higher-pitched voices and that people preferred to vote for politicians with lower-pitched rather than higher-pitched voices. Furthermore, lower voice pitch was more strongly associated with physical prowess than with integrity in a wartime voting scenario. Thus, sensitivity to vocal cues to dominance was heightened during wartime. In Study 2, we found that participants preferred to vote for the candidate with the lower-pitched voice when given the choice between two unfamiliar men's voices speaking a neutral sentence. Taken together, our results suggest that candidates' voice pitch has an important influence on voting behavior and that men with lower-pitched voices may have an advantage in political elections.

Keywords: Voice; Vocal; Attractiveness; Dominance; Leadership; Vote; Voting; Pitch

1. Introduction

Natural selection may have favored the ability to detect qualities of effective leadership because the choice of a leader affects an individual's ability to survive and reproduce within a social group (Darwin, 1871; Trivers, 1971). Today, group leaders are often chosen in national elections. Government officials directly affect social policies that contribute to reproductive success via allocation of vital resources. Therefore, choosing good leadership qualities in political candidates may be adaptive.

Despite the ubiquity of visual media technology, the sound of politicians' voices alone may influence voters' perceptions of candidates. Indeed, it has been shown that politicians with more attractive voices are perceived more positively than politicians with less attractive voices (Surawski & Ossoff, 2006). Furthermore, Gregory and Gallagher (2002) analyzed audio tapes from 19 US presidential debates between 1960 and 2000 and found that those candidates who had more acoustic energy concentrated at lower vocal frequencies won the popular vote of all eight elections they analyzed.

Studies of men's vocal attractiveness have identified voice pitch as a strong acoustic correlate of male vocal attractiveness (Collins, 2000). Subsequent studies have demonstrated that both men and women find men with lower-pitched voices to be more attractive (Feinberg, DeBruine, Jones, & Little, 2008; Feinberg, Jones, Little, Burt, & Perrett, 2005; Jones, Feinberg, DeBruine, Little, & Vukovic, 2010) and dominant (Jones et al., 2010; Puts, Gaulin, & Verdolini, 2006; Puts, Hodges, Cardenas, & Gaulin, 2007) than those with higher-pitched voices. Jones et al. (2010) demonstrated that both men and women are equally sensitive to the relationship between voice pitch and male dominance.

Low voice pitch may have in part evolved as a dominance cue among men (Puts, 2010 for review). Subordinate men change their vocal pitch and speech patterns to match those of dominant men (Gregory & Webster, 1996), and men who think they are relatively more

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dominant lower their voice pitch in response to mate competition, whereas men who think they are relatively less dominant raise the pitch of their voices in response to mate competition (Puts et al., 2006).

Although voting decisions result from a complex interaction of factors, mate-choice relevant factors can influence voting behavior. Recently, Navarrete, McDonald, Mott, Cesario, and Sapolsky (2010) showed that women's conception risk positively predicted their intention to vote for Barack Obama in the 2008 US presidential election and that this effect was strongest among women who perceived him as more white than black. Little, Burriss, Jones, and Roberts (2007) demonstrated that voters preferred to vote for candidates with relatively more masculine and dominant faces, but not relatively more attractive faces. Furthermore, a candidate's facial appearance can influence voters' perceptions in a very short period of time. Todorov, Mandisodza, Goren, and Hall (2005) showed that inferences of competence from a 1-s exposure to candidates' faces accurately predicted the outcomes of US congressional elections from 2000 to 2004. Little et al. (2007) also showed that voters preferred masculine and dominant faces in wartime but preferred attractive faces in peacetime.

When at war, it may be particularly important to choose an effective group leader. There is recent evidence that people can accurately assess upper body strength from men's voices and that these vocal cues can be used to assess men's fighting ability (Sell et al., 2010). Unlike strength, perceptions of body size based on voice pitch are often wrong and exhibit a consistent misattribution bias (Rendall, Vokey, & Nemeth, 2007). Vocal cues to physical strength may be more important in a leader during wartime than in peacetime because stronger men are more likely to favor the use of military force than are weaker men (Sell, Tooby, & Cosmides, 2009).

While facial appearance alters voting behavior (Little et al., 2007; Todorov et al., 2005) and voice qualities are related to election outcomes and voting behavior (Gregory & Gallagher, 2002; Surawski & Ossoff, 2006), no study has investigated the role of voice pitch in voting-related perceptions. In Study 1, we addressed this gap in the literature using voice recordings of past US presidents. We manipulated the voice pitch of each recording and asked participants to attribute personality traits and to choose the version of the voice they preferred to vote for. We hypothesized that voice pitch would be negatively related to voting choices. We also hypothesized that the relationship between voice pitch and dominance would more strongly influence voting behavior in the wartime scenario than in the general national election scenario.

In Study 2, we tested whether the effects we observed in Study 1 could be replicated using unfamiliar male voices speaking a neutral sentence. We manipulated the pitch of each voice and asked participants to choose the voice they preferred to vote for between a high-pitch version of one person's voice and the low-pitch version of a different person's voice. Again, we hypothesized that voice pitch would be negatively related to voting choices.

2. Study 1

2.1. Methods

2.1.1. Participants

Participants (N=125) included 61 females (mean age=19.61±2.23 years) and 64 males (mean age=21.59±4.23 years) who received course credit or payment in exchange for participation.

2.1.2. Stimuli

We obtained voice recordings of nine United States presidents from the online archive of the Vincent Voice Library of Michigan State University (http://vvl.lib.msu.edu; available in the online Appendix at www.ehbonline.org). We created a lower-pitched and higher-pitched version of each president's voice using the Pitch-Synchronous Overlap Add (PSOLA, France Telecom) method in Praat software (Boersma & Weenink, 2009). The PSOLA method selectively manipulates fundamental frequency and related harmonics while controlling for other spectrotemporal features of the acoustic signal (Feinberg et al., 2005). We manipulated voice pitch by raising or lowering the pitch by 0.5 equivalent rectangular bandwidth of the baseline frequency, which is perceptually equivalent to lowering the pitch of an average male voice (120 Hz) by 20 Hz and corrects for the difference between actual fundamental frequency and perceived fundamental frequency (Traunmüller, 1990). This level of pitch manipulation has been used successfully in previous studies on voice pitch (Apicella & Feinberg, 2009; Feinberg et al., 2008; Jones, Feinberg, DeBruine, Little, & Vukovic, 2008; Jones et al., 2010; Vukovic et al., 2008).

2.1.3. Procedure

We organized trials into two blocks, each comprised of nine trials (one for the two versions of each president's voice) for each of five attributions, for a total of 45 trials per block. In one block, the five attribution categories presented were: "Choose the voice that (1) sounds more attractive; (2) would be a better leader; (3) is a more honest leader; (4) sounds more trustworthy; and (5) you are most likely to vote for in a national election." The five attribution categories in the other block were: "Choose the voice that (1) sounds more dominant; (2) you think would better handle the current economic situation; (3) sounds more intelligent; (4) you think is more likely to be involved in a government scandal; and (5) you are more likely to vote for in a time of war." The order of attribution categories was randomized within each block, and the order of the two blocks was counterbalanced between participants.

In each trial, the lower- and higher-pitched versions of one president's voice were presented on a computer screen in a two-alternative forced-choice paradigm. Participants

listened to each version of the voice consecutively through headphones connected to the computer. The side of the screen on which the play button for each version of the voice was displayed was randomized. Presidents' identities were grouped by attribution category, but were randomly ordered within attribution categories.

2.1.4. Statistics

For each attribution, we calculated the proportion of trials in which each participant chose the lower-pitched voice. Therefore, each variable used in our analyses reflects the proportion of trials in which lower-pitched voices were chosen for that particular attribution. We used SPSS Statistics 19.0 with two-tailed p values.

2.2. Results

2.2.1. Initial processing of data

To test for differences in the responses of men and women, we preformed independent-samples t tests. After Bonferroni correction for multiple comparisons at the α=.005 level, we found that women chose lower-pitched voices significantly more often than men for the attribution of intelligence (t_{123}=−3.305, p=.003), while the difference between sexes for ability to handle the current economic situation was very close to significance (t_{123}=−2.801, p=.006). There were no other sex differences in responses after correcting for multiple comparisons at the α=.005 level (all $|t|_{123}$<2.470, all $p\geq$.015). Therefore, we combined the responses of both sexes in subsequent analyses.

2.2.2. Influence of voice pitch on perceptions

To determine if participants chose lower-pitched voices more or less often than predicted by chance (0.50), we performed one-sample t tests for each attribution separately (Table 1). After Bonferroni correction for multiple comparisons at the α=.005 level, we found that participants chose lower-pitched voices significantly more often than predicted by chance for each of the attributions (all $|t|_{124}$>3.493, all $p\leq$.001) except likelihood of involvement in a government scandal, for which participants chose lower-pitched voices significantly less often than predicted by chance (t_{124}=−3.724, p<.001). We repeated the above t tests using only the first attribution category that each participant completed and found that there were no differences in the directions of the relationships reported above.

Table 1
Proportion of trials in which participants (N=125) chose the lower-pitched voice in Study 1

Attribution	Mean±S.E.	t value	p value
Dominance	.778±.020	13.571	<.001**
Attractiveness	.732±.020	11.716	<.001**
Leadership	.685±.023	8.186	<.001**
Voting in national election scenario	.671±.022	7.835	<.001**
Voting in wartime scenario	.667±.024	6.989	<.001**
Ability to handle current economic situation	.663±.021	7.590	<.001**
Trustworthiness	.653±.021	7.372	<.001**
Intelligence	.634±.023	5.835	.001*
Honesty	.580±.023	3.493	<.001**
Likelihood of involvement in government scandal	.410±.024	−3.724	<.001**

All p values survived Bonferroni correction for multiple comparisons at the α=.005 level.
* p<.05.
** p<.001.

2.2.3. Principal component analysis

We used principal component analysis with varimax rotation to reduce the number of factors predicting reported voting behavior in the model. This approach has been used previously to identify underlying dimensions from trait judgments of faces (Oosterhof & Todorov, 2008). This analysis produced two factors that were extracted using the regression technique. The first factor explained 27.96% of the variance and had an eigenvalue of 2.24. High scores on this factor indicated a higher proportion of trials in which lower-pitched voices were associated with trustworthiness, honesty, intelligence, ability to handle the current economic situation, and likelihood of being involved in a government scandal. We labeled this factor *integrity*. The second factor explained 21.20% of the variance and had an eigenvalue of 1.70. High scores on this factor indicated a higher proportion of trials in which lower-pitched voices were associated with dominance, leadership, and attractiveness. We labeled this factor *physical prowess* (Table 2). Before executing subsequent analyses, we transformed integrity and physical prowess into binary variables split at the median: all values above the median (N=62) were assigned a value of 1, and all values below and including the median (N=63) were assigned a value of 0. We used α=.05 for all subsequent analyses.

2.2.4. Influence of voice pitch on voting

To analyze the relationship between the degree to which lower-pitched voices were associated with integrity and physical prowess and the degree to which lower-pitched voices were chosen in each of the two voting scenarios, we

Table 2
Rotated component matrix and factor loadings for principal component analysis in Study 1

Proportion of trials in which lower-pitched voices associated with:	Integrity	Physical prowess
Trustworthiness	.737	.171
Honesty	.629	−.057
Intelligence	.623	.100
Ability to handle current economic situation	.611	.310
Likelihood of involvement in government scandal	−.702	.052
Dominance	−.052	.757
Leadership	.191	.754
Attractiveness	.071	.642

performed a multivariate analysis of covariance [dependent variable: voting scenario (national election, time of war); between-subjects factor: sex (male, female); covariates: integrity, physical prowess]. There were significant main effects of the degree lower-pitched voices were associated with integrity ($F_{1, 121}$=10.789, p=.001) and physical prowess ($F_{1, 121}$=20.967, p<.001) on the proportion of trials in which lower-pitched voices were chosen in the national election scenario. In the wartime scenario, there were significant main effects of sex ($F_{1, 121}$=5.237, p=.024) and the degree to which lower-pitched voices were associated with physical prowess ($F_{1, 121}$=24.451, p<.001) on the proportion of trials in which lower-pitched voices were chosen. There were no other significant main effects or interactions (all $F_{1, 121}$<2.122, all p>.149; Table 3).

2.2.5. Differences between voting scenarios

We performed a paired t test to determine if participants chose lower-pitched voices more often in the national election or wartime scenario. There was no significant difference between how often lower-pitched voices were chosen in the two scenarios (t_{124}=.160, p=.874). To test whether the degree lower-pitched voices were associated with integrity and physical prowess differed significantly between the two voting scenarios, we performed an analysis of covariance [within-subjects factor: voting scenario (national election, time of war); between-subjects factor: sex (male, female); covariates: integrity, physical prowess]. There were significant interactions between voting scenario and sex of participant ($F_{1, 121}$=5.09, p=.026) and voting scenario and perceptions of integrity ($F_{1, 121}$=9.37, p=.003). There were no other significant main effects or interactions (all $F_{1, 121}$<.494, all p>.484; Table 3).

Prior research shows that perceptions of attractiveness and dominance based on voice pitch are separable (Jones et al., 2010; Puts, 2010). Although perceptions of both attractiveness and dominance contributed to the physical prowess factor, we sought to directly test whether perceptions of attractiveness or dominance were driving the difference between the two voting scenarios. We performed an ANCOVA [dependent variable: voting scenario (national election, time of war); covariates: attractiveness, dominance]. In the national election scenario, perceptions of both attractiveness ($F_{1, 124}$=5.837, p=.017) and dominance ($F_{1, 124}$=7.255, p=.008) significantly predicted voting preferences. In the wartime scenario, voting preferences were predicted by perceptions of dominance ($F_{1, 123}$=11.971, p=.001), but not by perceptions of attractiveness ($F_{1, 123}$=1.736, p=.190).

3. Study 2

The aim of Study 2 was to test if the influence of voice pitch on voting preferences we observed in Study 1 could be replicated using voices of nonpoliticians speaking nonpolitical content in a situation where participants chose between the voices of two different people rather than two versions of the same person's voice.

3.1. Methods

3.1.1. Participants

Participants (N=40) were 20 females (mean age=22.75±3.48 years) and 20 males (mean age=22.85±3.66 years) who received payment in exchange for participation.

3.1.2. Stimuli

We obtained voice recordings of six males speaking the sentence "When the sunlight strikes raindrops in the air, they act as a prism and form a rainbow" (Fairbanks, 1960). We created a lower-pitched and higher-pitched version of each voice using the same method described in Study 1. Each of

Table 3
Proportion of lower-pitched voices chosen (mean±S.E.) in each voting scenario in Study 1 and Pearson correlations as a function of the influence of voice pitch on perceptions of integrity and physical prowess and sex of participant

Degree of influence of voice pitch on perception	Sex	Voting scenario					
		National election			Time of war		
		Proportion	Pearson r	p value	Proportion	Pearson r	p value
High influence on integrity	Male (n=29)	.743±.04	.397*	.033	.770±.05	.213	.267
	Female (n=33)	.751±.04	.375*	.032	.603±.06	.378*	.030
	All (n=62)	.747±.03	.355**	.005	.681±.04	.180	.163
Low Influence on integrity	Male (n=35)	.552±.04	.486**	.003	.679±.03	−.369*	.029
	Female (n=28)	.651±.04	−.241	.216	.631±.05	−.029	.885
	All (n=63)	.596±.03	.310*	.013	.653±.03	−.238	.060
High influence on physical prowess	Male (n=32)	.743±.04	−.123	.503	.851±.02	−.018	.921
	Female (n=30)	.793±.03	.247	.188	.696±.05	.252	.180
	All (n=62)	.767±.02	.005	.971	.776±.03	.193	.133
Low influence on physical prowess	Male (n=32)	.535±.04	.409*	.020	.580±.04	.098	.592
	Female (n=31)	.620±.04	.319	.080	.538±.05	.411*	.022
	All (n=63)	.577±.03	.392**	.001	.559±.03	.211	.096

* p<.05.
** p<.01.

the voices that we lowered in pitch (mean pitch=97.06± 15.99 Hz) was lower than each of the voices that we raised in pitch (mean pitch=135.22±18.27 Hz).

3.1.3. Procedure

We organized trials into two blocks and randomly assigned each participant to one block. Each block consisted of 15 trials of the same two-alternative forced-choice paradigm described in Study 1, except that in Study 2, all trials presented a choice between two different speaker identities. In each trial, participants were asked to "Choose the voice that you are most likely to vote for in a national election" between the raised-pitched version of one person's voice and the lowered-pitched version of another person's voice. The raised-pitch and lowered-pitch versions of each speaker identity were reversed in the two blocks. We asked participants to indicate if they recognized any of the voices by clicking on a button at the bottom of the screen. We calculated the proportion of trials in which each participant chose the lower-pitched voice as described in Study 1.

3.2. Results

To determine if participants chose lower-pitched voices more often than predicted by chance (0.50), we performed a one-sample t test. We found that participants chose lower-pitched voices significantly more often than predicted by chance (mean=.698±.03, t_{39}=7.099, p<.001). A one-way analysis of variance [dependent variable: proportion of lower-pitched voices chosen; independent variables: sex, block] revealed no differences between the responses of the two sexes, neither between the two blocks, nor was there a sex by block interaction (all $F_{1, 36}$<45.94, all p>.093). No participants indicated recognizing any of the speaker identities.

4. Discussion

In Study 1, we found that lower-pitched voices were associated with favorable personality traits more often than were higher-pitched voices (Table 1). This finding is consistent with previous work demonstrating that lower-pitched men's voices sound more dominant and attractive than do higher-pitched men's voices (see Feinberg, 2008 for review; Jones et al., 2010; Puts et al., 2006; Puts et al., 2007). Our research suggests that the relationship between voice pitch and dominance is relevant for a range of social situations that can alter fitness, including political decisions.

Since voice pitch is negatively related to testosterone levels (Dabbs & Mallinger, 1999; Harries, Walker, Williams, Hawkins, & Hughes, 1997) and dominant men have higher testosterone levels than subordinate men do (Mazur & Booth, 1998; Swaddle & Reierson, 2002), the pattern of attributions we observed is potentially adaptive because voice pitch is likely a valid cue to men's dominance. Our results also provide converging evidence that dominant-sounding male voices are perceived positively while dominant male faces are perceived negatively (Perrett et al., 1998). Recent work, however, demonstrated that lower-pitched men's voices are associated with high perceived infidelity risk (O'Connor, Re, & Feinberg, 2011). Future research should investigate similarities and differences in perceptions of vocal and facial masculinity in different social contexts.

A potential alternative explanation for the above pattern of attributions is that participants demonstrated a general response bias to lower-pitched voices. If our results were due to a general response bias to masculine stimuli, participants would have always selected the lower-pitched voices over the higher-pitched voices. This did not happen. Participants chose the higher-pitched voices significantly more often than expected by chance when asked to choose the voice more likely to be involved in a government scandal (Table 1). It is also unlikely that these results are due to potential demand characteristics because we found no differences in the directions of the relationships when we analyzed only the first attribution category completed by each participant. Additionally, we reduced the potential influence of demand characteristics by randomizing the order of attribution categories within each block.

Furthermore, we found in Study 1 that participants preferred to vote for politicians with lower-pitched voices over politicians with higher-pitched voices in both the national election scenario and the wartime scenario. Lower voice pitch was more strongly associated with integrity in the national election scenario than in the wartime scenario, while lower voice pitch was associated with physical prowess to the same degree in both voting scenarios. In the national election scenario, the more likely people were to associate lower-pitched voices with integrity and physical prowess, the more likely they were to say they would vote for politicians with lower-pitched voices. In the wartime scenario, if people perceived lower-pitched voices as indicative of physical prowess, they were more likely to say they would vote for lower-pitched voices. If people perceived lower-pitched voices as possessing more integrity, however, they were no more likely to say they would vote for lower-pitched voices. Therefore, in the wartime scenario, voting decisions were influenced by vocal cues to physical prowess, but not by vocal cues to integrity, suggesting that perceptions of integrity influenced voting decisions less strongly than physical prowess in this scenario.

Although low voice pitch was associated with both attractiveness and dominance, voting preferences in the wartime scenario were more closely tied to perceptions of dominance than to attractiveness. Recently, Sell et al. (2010) demonstrated that people can accurately assess upper body strength from men's voices alone, which is

consistent with the pattern of pitch-based perceptions we present here. Puts, Apicella, and Cardenas (2011) also found that formant position, another measure of vocal masculinity, negatively predicted men's arm strength. Even though elected officials do not usually participate in warfare directly, Sell et al. (2009) found that stronger men were more likely to favor the use of military force than were weaker men. Our research supports the hypothesis that voters possess evolved mechanisms for accurately assessing vocal cues to strength and dominance in potential leaders, which may be adaptive if strength and dominance were accurate predictors of success in warfare throughout our evolutionary history.

In Study 2, we found that the preference to vote for men with lower-pitched voices was not specific to politicians speaking political content, nor was it specific to a forced choice between two versions of the same person's voice. The results of Study 2 extend our findings to a more ecologically valid scenario: a choice between two different candidates, one with a higher voice pitch and one with a lower voice pitch. When given the choice between two unfamiliar candidates speaking a neutral sentence, participants preferred to vote for the candidate with the lower-pitched voice more often than the one with the higher-pitched voice.

To our knowledge, our study is the first to investigate the influence of voice pitch on perceptions of politicians. Our results suggest that men with lower-pitched voices may have an advantage in political elections. It is possible that artificially lowering one's voice pitch in audio recordings could help candidates gain votes. In addition, voters may pay more attention to vocal cues of dominance during wartime. Although political leaders do not normally take part in physical combat, voters' sensitivity to vocal cues to strength may be adaptive if men's strength predicts their likelihood to use military force.

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:10.1016/j.evolhumbehav.2011.09.004.

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